(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 540 557 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
18.09.2019 Bulletin 2019/38

(21) Application number: **17870032.4**

(22) Date of filing: **09.10.2017**

(51) Int Cl.:
G06F 1/16 *(2006.01)* ***F16C 11/04*** *(2006.01)*

(86) International application number:
PCT/CN2017/105406

(87) International publication number:
WO 2018/086432 (17.05.2018 Gazette 2018/20)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **10.11.2016 CN 201610989652**

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(54) COMPOSITE SHAFT ASSEMBLY, MULTI-FUNCTION KEYBOARD, AND TABLET COMPUTER EXTERNAL COMPONENT

(57) The present disclosure discloses a composite hinge assembly, comprising a clamping portion and a rotating shaft portion fixed relative to the clamping portion and extending out of the two ends of the clamping portion. An inner surface of the clamping portion defining a slot, and an outer surface of the clamping portion is a damping layer made of an elastic material. The present disclosure also discloses a tablet computer kit and a multi-functional keypad thereof. By designing a composite hinge assembly and applying it to a multi-functional keypad, the present disclosure makes it possible that after the tablet computer is mounted on the multi-functional keypad, the rotating shaft can be stably fixed at any desired angles through the use of a damping layer made of an elastic material on the surface of the composite hinge assembly. Such a design is simple in structure, has a low manufacturing cost, and improves the appearance and operational reliability of the multi-functional keypad.

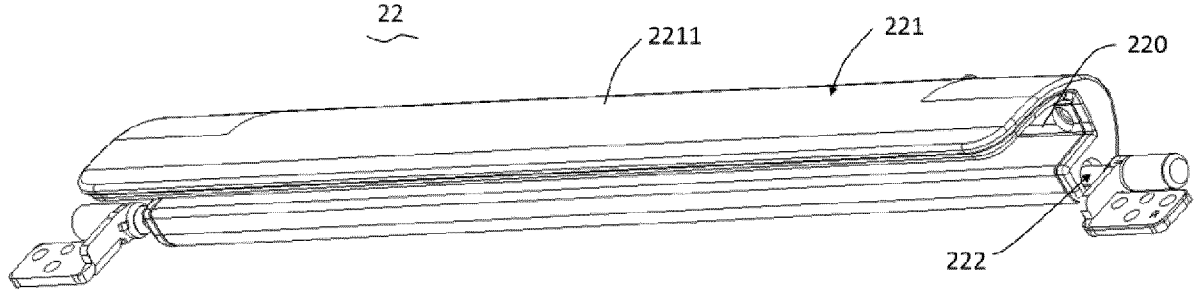

Fig. 5

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to tablet computers and auxiliary accessories thereof, in particular to a composite hinge assembly, a multi-functional keypad and a tablet computer kit.

BACKGROUND

[0002] Today, with the popularity of mobile Internet technology, tablet computers, in contrast to laptops, play an important role in personal applications, allowing people to stay in close contact with the world all the time. Since the interactive mode of tablet computers relies heavily on the touch screen, its interaction efficiency in many usage scenarios is relatively low. Also, as a user needs to hold the device by hand during long-term use or viewing of the screen, the use experience is adversely affected.

[0003] Therefore, two-in-one tablets came into being. By designing a support keypad that integrates the keypad function and the support function, it is possible to provide a more efficient input method while providing support. However, as the user's requirements for the appearance and weight of portable two-in-one tablet and keypad kits increase, there is a contradiction in that a complex design will increase the product's cost, weight, and affect its appearance, while overly simple support keypads mostly can only enable a tablet computer to stand at a fixed angle, which affects user experience.

SUMMARY

[0004] In view of the deficiencies of the related art, the present disclosure provides a composite hinge assembly having a simple structure, a low manufacturing cost, and supporting multiple angles of fixation, as well as a multi-functional keypad and a tablet computer kit.

[0005] In order to achieve the above object, the present disclosure adopts the following technical solutions:

[0006] There is provided a composite hinge assembly, comprising a clamping portion and a rotating shaft portion fixed relative to the clamping portion and extending out of the two ends of the clamping portion, an inner surface of the clamping portion defining a slot and an outer surface of the clamping portion being a damping layer made of an elastic material.

[0007] In one embodi ment, the outer surface of the clampi ng portion is a cam surface.

[0008] In one embodiment, the clamping portion comprises an inner housing and an outer housing, the slot is formed on a surface of the inner housing, the damping layer is formed on a surface of the outer housi ng; the outer housi ng comprises a curved outer wall facing the inner housing and for arranging the damping layer and side walls provided at the two end faces of the outer wall, the inner housing and the outer and side walls of the outer housing enclose a receiving cavity; the rotating shaft portion passes through the side walls and is fixed in the receiving cavity.

[0009] In one embodiment, the rotating shaft portion comprises two rotating shaft portions disposed respectively at the two ends of the outer housing.

[0010] The composite hinge assembly further comprising a mounting plate disposed in the receiving cavity, wherein the rotating shaft portion comprises a planar contact surface fastened to a surface of the mounti ng plate.

[0011] The composite hinge assembly further comprising a plurality of magnetic blocks disposed in the receiving cavity, the plurality of magnetic blocks being arranged in a row at a bottom of the slot.

[0012] In one embodiment, the composite hinge assembly further comprising a damping block protruding from the surface of the damping layer.

[0013] Another object of the present disclosure is to provide a multi-functional keypad comprising a keypad body and a composite hinge assembly disposed on the keypad body, wherein the composite hinge assembly includes a clamping portion and a rotating shaft portion fixed relative to the clamping portion and extending out of the two ends of the clamping portion, the clamping portion has an inner surface which defines a slot and an outer surface which is a damping layer made of an elastic material; the composite hinge assembly is rotatably disposed on the keypad body by means of the rotating shaft portion at the two ends.

[0014] In one embodiment, the outer surface of the clamping portion is a cam surface.

[0015] In one embodiment, the clamping portion comprises an inner housing and an outer housing, the slot is formed on a surface of the inner housing, the damping layer is formed on a surface of the outer housi ng; the outer housi ng comprises a curved outer wall facing the inner housing and for arranging the damping layer and side walls provided at the two end faces of the outer wall, the inner housing and the outer and side walls of the outer housing enclose a receiving cavity; the rotating shaft portion passes through the side walls and is fixed in the receiving cavity.

[0016] In one embodiment, the rotating shaft portion comprises two rotating shaft portions disposed respectively at the two ends of the outer housing.

[0017] The composite hinge assembly further comprising a mounting plate disposed in the receiving cavity, wherein the rotating shaft portion comprises a planar contact surface fastened to a surface of the mounti ng plate.

[0018] The composite hinge assembly further comprising a plurality of magnetic blocks disposed in the receiving cavity, the plurality of magnetic blocks being arranged in a row at a bottom of the slot.

[0019] In one embodiment, the composite hinge assembly further comprising a damping block, which protrudes from the surface of the damping layer.

[0020] Still another object of the present disclosure is

to provide a tablet computer kit, comprising a tablet computer and a multi-functional keypad, the multi-functional keypad comprising a keypad body and a composite hinge assembly disposed on the keypad body, wherein the composite hinge assembly includes a clamping portion and a rotating shaft portion fixed relative to the clamping portion and extending out of the two ends of the clamping portion, the clamping portion has an inner surface which defines a slot and an outer surface which is a damping layer made of an elastic material; the composite hinge assembly is rotatably disposed on the keypad body by means of the rotating shaft portion at the two ends, and the tablet computer configured to be inserted into the slot.

[0021] In one embodiment, the outer surface of the clamping portion is a cam surface.

[0022] In one embodiment, the clamping portion comprises an inner housing and an outer housing, the slot is formed on a surface of the inner housing, the damping layer is formed on a surface of the outer housi ng; the outer housi ng comprises a curved outer wall facing the inner housing and for arranging the damping layer and side walls provided at the two end faces of the outer wall, the inner housing and the outer and side walls of the outer housing enclose a receiving cavity; the rotating shaft portion passes through the side walls and is fixed in the receiving cavity.

[0023] The composite hinge assembly further comprising a mounting plate disposed in the receiving cavity, wherein the rotating shaft portion comprises a planar contact surface fastened to a surface of the mounti ng plate.

[0024] The composite hinge assembly further comprising a plurality of magnetic blocks disposed in the receiving cavity, the plurality of magnetic blocks being arranged in a row at a bottom of the slot.

[0025] In one embodiment, the composite hinge assembly further comprising a damping block, which protrudes from the surface of the damping layer.

[0026] The present disclosure provides a composite hinge assembly and applies it to a multi-functional keypad. Since the surface of the composite hinge assembly has a damping layer made of an elastic material, the rotating shaft can be stably fixed in any desired angle after the tablet computer is mounted on the keypad. Such a design is simple in structure, has a low manufacturing cost, and improves the appearance and operational reliability of the keypad.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIG. 1 is a schematic diagram of a use state of a multi-functional keypad according to an embodiment of the present disclosure.

FIG. 2 is a schematic diagram of another use state of a multi-functional keypad according to an embodiment of the present disclosure.

FIG. 3 is a schematic diagram of still another use state of a multi-functional keypad according to an embodiment of the present disclosure.

FIG. 4 is a schematic exploded view of a tablet computer kit according to an embodiment of the present disclosure.

FIG. 5 is a schematic structural view of a composite hinge assembly according to an embodiment of the present disclosure.

FIG. 6 is a partial enlarged view of a composite hinge assembly according to an embodiment of the present disclosure.

FIG. 7 is a schematic diagram showing the internal structure of a composite hinge assembly according to an embodiment of the present disclosure.

FIG. 8 is a schematic exploded view showing the structure of a composite hinge assembly according to an embodiment of the present disclosure.

FIG. 9 is a cross-sectional structural view of a composite hinge assembly according to an embodiment of the present disclosure.

FIG. 10 is a cross-sectional view showing the internal structure of a composite hinge assembly according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0028] The present disclosure will be further described in detail below with reference to the accompanying drawings and embodiments. It is understood that the specific embodiments described herein are illustrative only and are not intended to limit the present disclosure.

[0029] FIGs. 1 to 3 are schematic diagrams showing multiple use states of a multi-functional keypad according to embodiments of the present disclosure. FIG. 1 is a state in which a tablet computer 10 is completely closed; FIG. 2 is a state where the tablet computer 10 is opened at an obtuse angle with respect to the keypad 20; and FIG. 3 is a state where the tablet computer 10 is opened at an acute angle with respect to the keypad 20.

[0030] As shown in FIG. 4, the tablet computer 10 and the keypad 20 constitute tablet computer fittings. The multi-functional keypad 20 of the present embodiment may have a keypad body 21 and a composite hinge assembly 22 disposed at one end of the keypad body 21. With reference to FIG. 5, the composite hinge assembly 22 may be rotatably disposed on the keypad body 21 through the rotating shaft portion 222 at the two ends. The tablet computer 10 may be freely disposed at any desired angles relative to the keypad 20 while bei ng inserted into a slot 220 of the keypad 20.

[0031] The structure of the composite hinge assembly 22 ensures an arbitrary opening angle of the tablet computer 10. As shown in FIGs. 5 and 6, the composite hinge assembly of the present embodiment may include a clamping portion 221 and a rotating shaft portion 222 fixed relative to the clamping portion 221 and extending out of the two ends of the clamping portion 221. A inner surface of the clamping portion 221 may define the slot

220 and a outer surface thereof may be a damping layer 2211 made of an elastic material. After the tablet computer 10 is inserted into the slot 220, as the clamping portion 221 is rotated about the rotating shaft portion 222 relative to the keypad body 21, the damping layer 2211 is pressed and comes into elastic contact with the keypad body 21, thereby enabling the tablet computer 10 to be stably disposed at any desired opening angles.

[0032] Preferably, the damping layer 2211 may be made of a silica gel, the clamping portion 221 may be made of plastic, and both the silica gel and the plastic may be hot pressed by a mold using glue. Here, owing to the frictional performance of the silica gel, it is possible to achieve a good engagement between the tablet computer and the keypad without needing any mechanical structure at the junction thereof while allowing the tablet computer to be rotated freely.

[0033] According to one embodiment, the outer surface of the clamping portion 221 may be a cam surface centered on the rotating shaft portion 222. As the clamping portion 221 is rotated to a larger angle, the damping layer 2211 will be pressed to a larger extent, such that the pressing force is offset by the turning force generated by the gravity of the tablet computer to achieve a stable positioning.

[0034] It will be understood that the rotating mechanism between the rotating shaft portion 222 at the two ends and the keypad body 21 can be one known in the related art, which is not described herein. For example, the rotating shaft portion 222 may be sleeved with a torsion spring to provide a partial torsion force required for closing the clamping portion 221.

[0035] With reference to FIGs. 6 and 7, the clamping portion 221 may include an inner housing 2212 and an outer housing 2213. The slot 220 may be formed on a surface of the inner housing 2212, and the damping layer 2211 may be formed on a surface of the outer housing 2213. The outer housing 2213 may include a curved outer wall facing the inner housing 2212 and for arranging the damping layer 2211 and side walls provided at the two end faces of the outer wall. The inner housing 2212 and the outer and side walls of the outer housing 2213 may enclose a receiving cavity. The rotating shaft portion 222 passes through the side walls and may be secured within the receivi ng cavity.

[0036] Preferably, there may be two rotating shaft portions 222, which may be provided at the two ends of the outer housing 2213, respectively. As shown in FIG. 8, a mounting plate 223, a plurality of magnetic blocks 224, and a damping block 225 may be disposed in the receiving cavity of the composite hinge assembly.

[0037] A inner surface of the outer housing 2213 may be provided with a plurality of studs 2213a protruding therefrom. The mounting plate 223 may be fixed to end surfaces of the plurality of studs 2213a by threaded fasteners. The surface of the rotating shaft portions 222 may be flattened to form a planar contact surface (not shown), which may be fastened to a correspondi ng surface of the mounti ng plate 223.

[0038] The plurality of magnetic blocks 224 may be arranged in a row at a bottom of the slot 220, that is, the plurality of magnetic blocks 224 may be fixed to the inner surface of the curved outer wall of the outer housi ng 2213 correspondi ng to the bottom of the slot 220. When the tablet computer 10 is inserted into the slot 220, the plurality of magnetic blocks 224 are attracted to the metal shell of the tablet computer 10 or corresponding magnets in the tablet computer 10, so that the tablet computer 10 is firmly attracted in the slot 220. Preferably, magnetic poles of two adjacent magnetic blocks 224 may be opposite to form a magnetic field superposition, thus increasing the overall adsorption force of the plurality of magnetic blocks.

[0039] The damping block 225 may be made of a silica gel or rubber. The damping block 225 may be protruded from a surface of the damping layer 2211 and may extend along a circumferential direction of the clamping portion 221. After the clamping portion 221 is rotated to the maximum opening angle, the damping block 225 will abut against a upper surface of the keypad body 21, which restricts the maximum opening angle. Preferably, there may be two damping blocks 225 which are disposed at two ends of the clamping portion 221, respectively.

[0040] With reference to FIGs. 8 to 10, the receiving cavity of the composite hinge assembly of the present embodi ment may be formed in the following manner: the inner housing 2212 may be composed of an upper housing 2212a and a lower housing 2212b. A top inner surface of the outer housing 2213 may be provided with a plurality of spaced-apart protruding lugs T, and a top surface of the upper housing 2212a may be correspondingly provided with a plurality of recesses (not shown), such that the plurality of protruding lugs T mate with the plurality of recesses to secure the upper housing 2212a. The lower housing 2212b may include a first end that engages the bottom of the outer housing 2213 and a second end that abuts the upper housing 2212a. The lower housing 2212b may be then secured relative to the outer housing 2213 through threaded fasteners.

[0041] A part of the mounting plate 223 may be fixed to the end surfaces of the plurality of studs 2213a by threaded fasteners, and a free end of the other part of the mounting plate 223 may extend toward a lower end surface of the upper housing 2212a. A inner surface of the lower housing 2212b may be further provided with a spacer B protruding therefrom. The spacer B may separate a mounting space of the plurality of magnetic blocks 224 from the mounti ng plate 223. The free end of the mounti ng plate 223 may be opposite to the spacer B. Preferably, the mounting plate 223 may be made of a metal. The mounting plate 223 may also be used to reinforce the lower housing 2212b if necessary.

[0042] By combining the various components flexibly and reasonably, the tablet computer kit allows the components to be used alone or in combination; the weight and volume of the multi-functional keypad are not signif-

icantly increased, and the composite hinge assembly has good structural strength, such that the structure is simple and the cost can be controlled. By defining various interfaces on the multi-functional keypad, it is possible to increase the extensibility and functional variety of the tablet computer.

[0043] The present disclosure provides a composite hinge assembly and applies it to a multi-functional keypad. Since the surface of the composite hinge assembly has a damping layer made of an elastic material, the rotating shaft can be stably fixed in any desired angle after the tablet computer is mounted on the keypad. Such a design is simple in structure, has a low manufacturing cost, and improves the appearance and operational reliability of the keypad.

[0044] While the above description sets forth specific embodiments of the present disclosure, it should be noted that improvements and modifications can be made by those of ordinary skills without departi ng from the principle of the present disclosure, which improvements and modifications should be considered to be within the scope of protection of present disclosure.

Claims

1. A composite hinge assembly, comprising a clamping portion and a rotating shaft portion fixed relative to the clamping portion and extending out of the two ends of the clamping portion, the clamping portion having an inner surface defining a slot and an outer surface which is a damping layer made of an elastic material.

2. The composite hinge assembly according to claim 1, wherein the outer surface of the clamping portion is a cam surface.

3. The composite hinge assembly according to claim 1, wherein the clamping portion comprises an inner housing and an outer housing, the slot is formed on a surface of the inner housing, the damping layer is formed on a surface of the outer housing; the outer housing comprises a curved outer wall facing the inner housing and for arranging the damping layer and side walls provided at the two end faces of the outer wall, the inner housing and the outer and side walls of the outer housing enclose a receiving cavity; the rotating shaft portion passes through the side walls and is fixed in the receivi ng cavity.

4. The composite hinge assembly according to claim 3, wherein the rotating shaft portion comprises two rotating shaft portions disposed respectively at the two ends of the outer housi ng.

5. The composite hinge assembly according to claim 3, further comprising a mounting plate disposed in the receiving cavity, wherein the rotating shaft portion comprises a planar contact surface fastened to a surface of the mounti ng plate.

6. The composite hinge assembly according to claim 3, further comprising a plurality of magnetic blocks disposed in the receiving cavity, the plurality of magnetic blocks being arranged in a row at a bottom of the slot.

7. The composite hinge assembly according to claim 1, further comprising a damping block protruding from a surface of the damping layer.

8. A multi-functional keypad comprising a keypad body and a composite hinge assembly disposed on the keypad body, wherein the composite hinge assembly comprises a clamping portion and a rotating shaft portion fixed relative to the clamping portion and extending out of the two ends of the clamping portion, the clamping portion has an inner surface which defines a slot and an outer surface which is a damping layer made of an elastic material; the composite hinge assembly is rotatably disposed on the keypad body by means of the rotati ng shaft portion at the two ends.

9. The multi-functional keypad according to claim 8, wherein the outer surface of the clamping portion is a cam surface.

10. The multi-functional keypad according to claim 8, wherein the clamping portion comprises an inner housing and an outer housing, the slot is formed on a surface of the inner housing, the damping layer is formed on a surface of the outer housing; the outer housing comprises a curved outer wall facing the inner housing and for arranging the damping layer and side walls provided at the two end faces of the outer wall, the inner housing and the outer and side walls of the outer housing enclose a receiving cavity; the rotating shaft portion passes through the side walls and is fixed in the receivi ng cavity.

11. The multi-functional keypad according to claim 10, wherein the rotating shaft portion comprises two rotating shaft portions disposed respectively at the two ends of the outer housi ng.

12. The multi-functional keypad according to claim 10, further comprising a mounting plate disposed in the receiving cavity, wherein the rotating shaft portion comprises a planar contact surface fastened to a surface of the mounti ng plate.

13. The multi-functional keypad according to claim 10, further comprising a plurality of magnetic blocks disposed in the receiving cavity, the plurality of mag-

netic blocks being arranged in a row at a bottom of the slot.

14. The multi-functional keypad according to claim 8, wherein the composite hinge assembly further includes a damping block protruding from a surface of the damping layer.

15. A tablet computer kit, comprising a tablet computer and a multi-functional keypad, the multi-functional keypad comprising a keypad body and a composite hinge assembly disposed on the keypad body, wherein the composite hinge assembly comprises a clamping portion and a rotating shaft portion fixed relative to the clamping portion and extending out of the two ends of the clamping portion, the clamping portion has an inner surface which defines a slot and an outer surface which is a damping layer made of an elastic material; the composite hinge assembly is rotatably disposed on the keypad body by means of the rotating shaft portion at the two ends, and the tablet computer configured to be inserted into the slot.

16. The tablet computer kit according to claim 15, wherein the outer surface of the clamping portion is a cam surface.

17. The tablet computer kit according to claim 15, wherein the clamping portion comprises an inner housing and an outer housing, the slot is formed on a surface of the inner housing, the damping layer is formed on a surface of the outer housing; the outer housing comprises a curved outer wall facing the inner housing and for arranging the damping layer and side walls provided at the two end faces of the outer wall, the inner housing and the outer and side walls of the outer housing enclose a receiving cavity; the rotating shaft portion passes through the side walls and is fixed in the receivi ng cavity.

18. The tablet computer kit according to claim 17, further comprising a mounting plate disposed in the receiving cavity, wherein the rotating shaft portion comprises a planar contact surface fastened to a surface of the mounti ng plate.

19. The tablet computer kit according to claim 17, further comprising a plurality of magnetic blocks disposed in the receiving cavity, the plurality of magnetic blocks being arranged in a row at a bottom of the slot.

20. The tablet computer kit according to claim 15, wherein the composite hinge assembly further includes a damping block protruding from a surface of the damping layer.

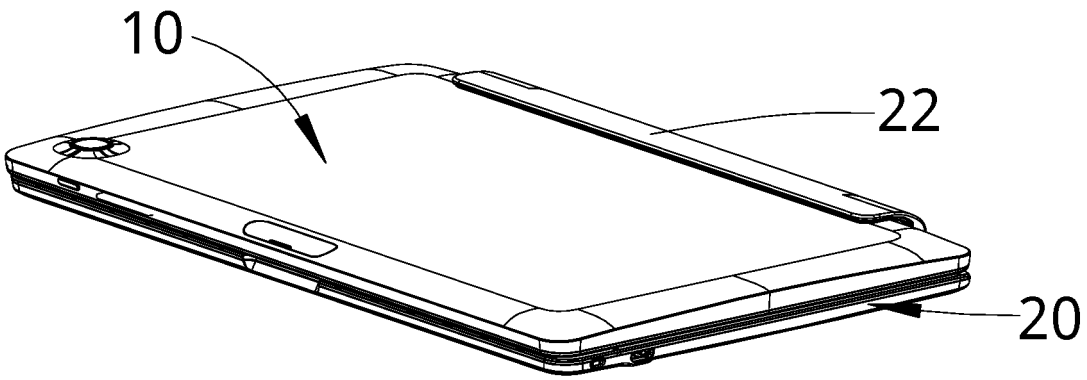


Fig. 1

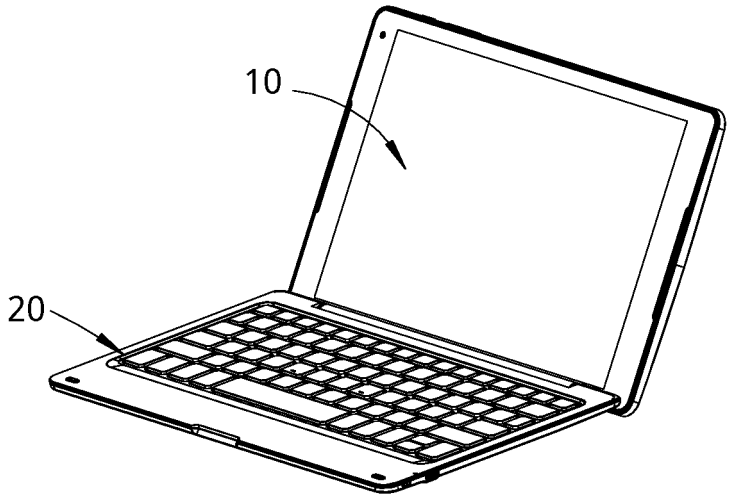


Fig. 2

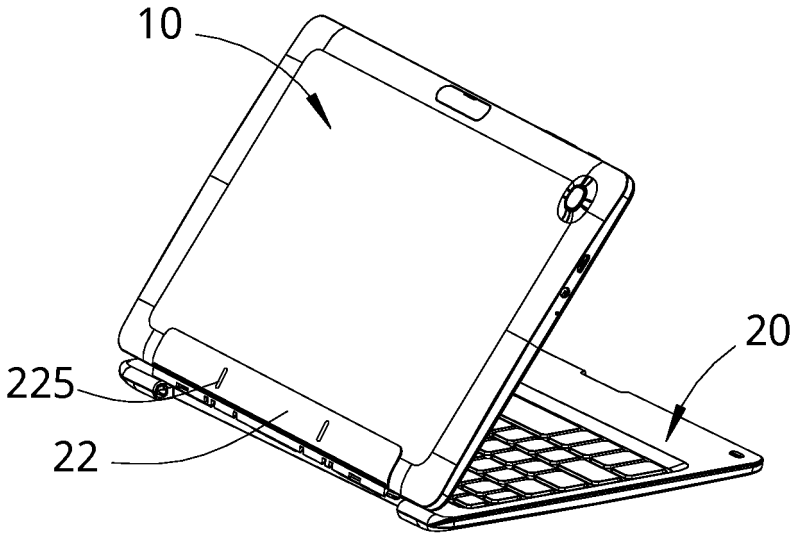


Fig. 3

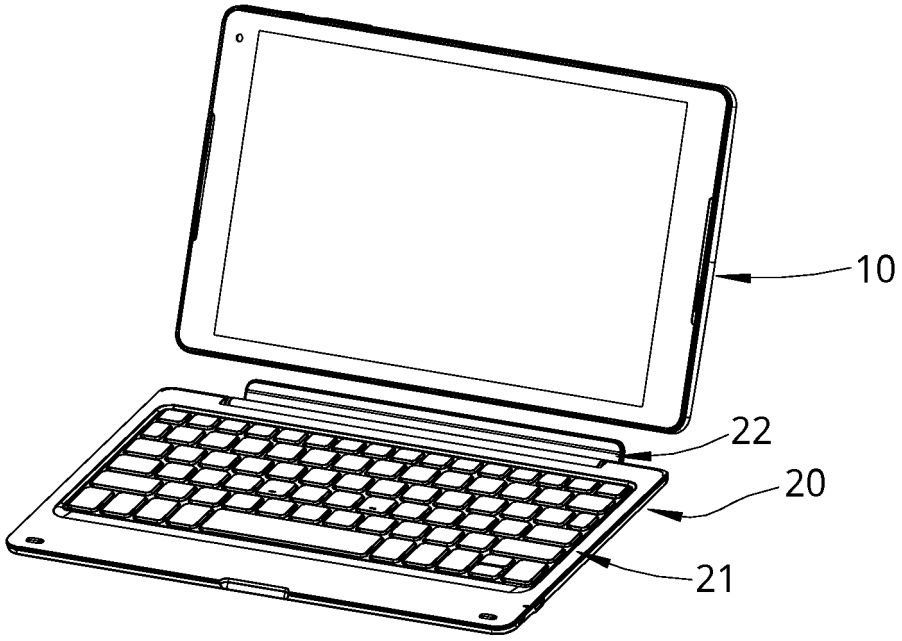


Fig. 4

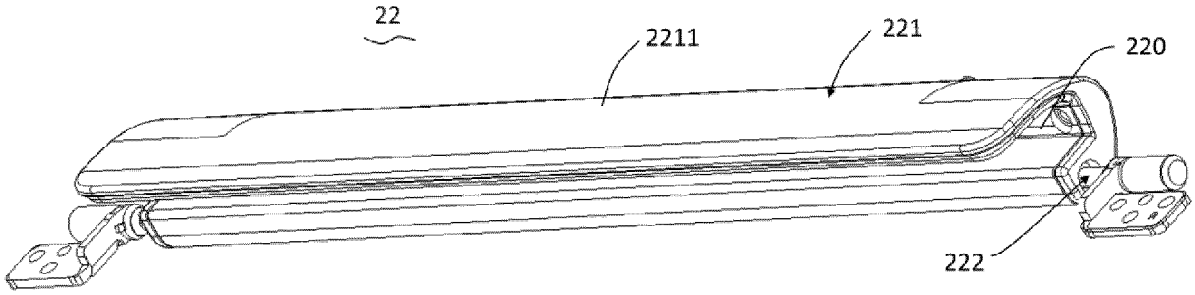


Fig. 5

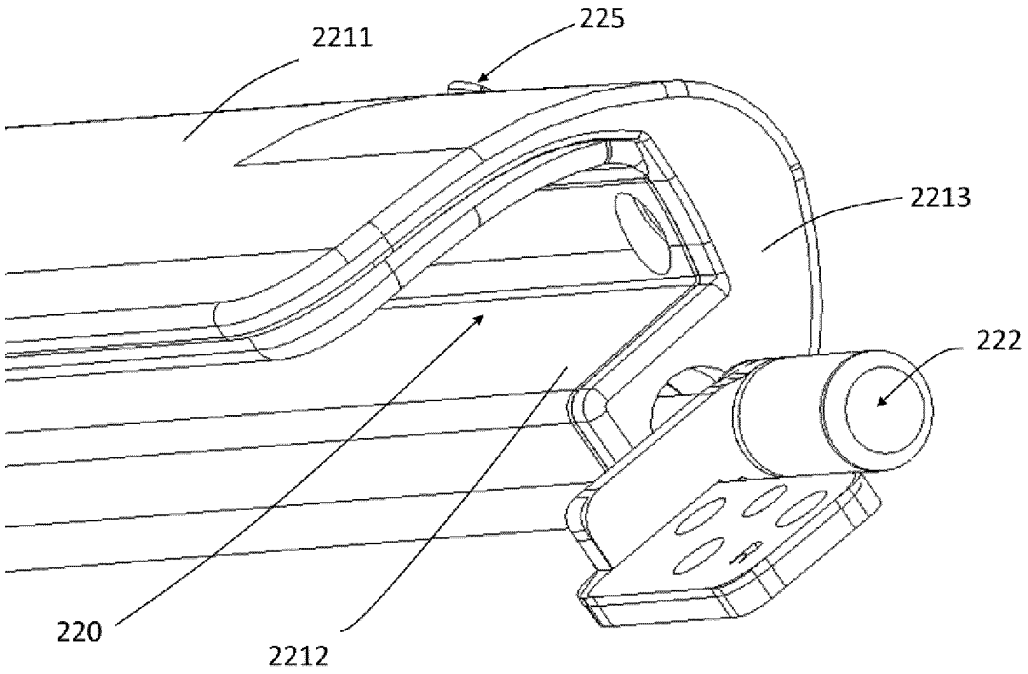


Fig. 6

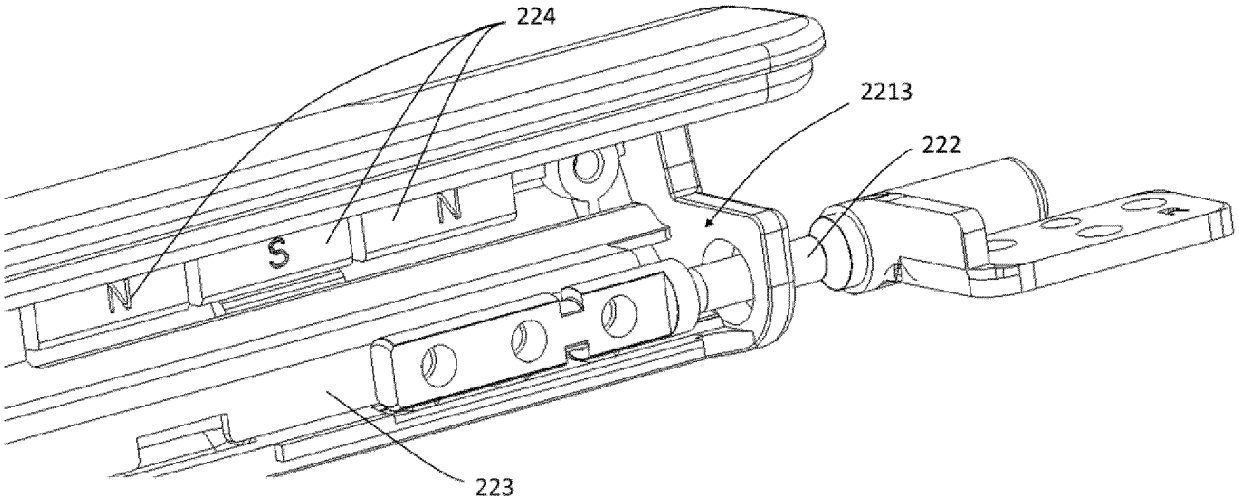
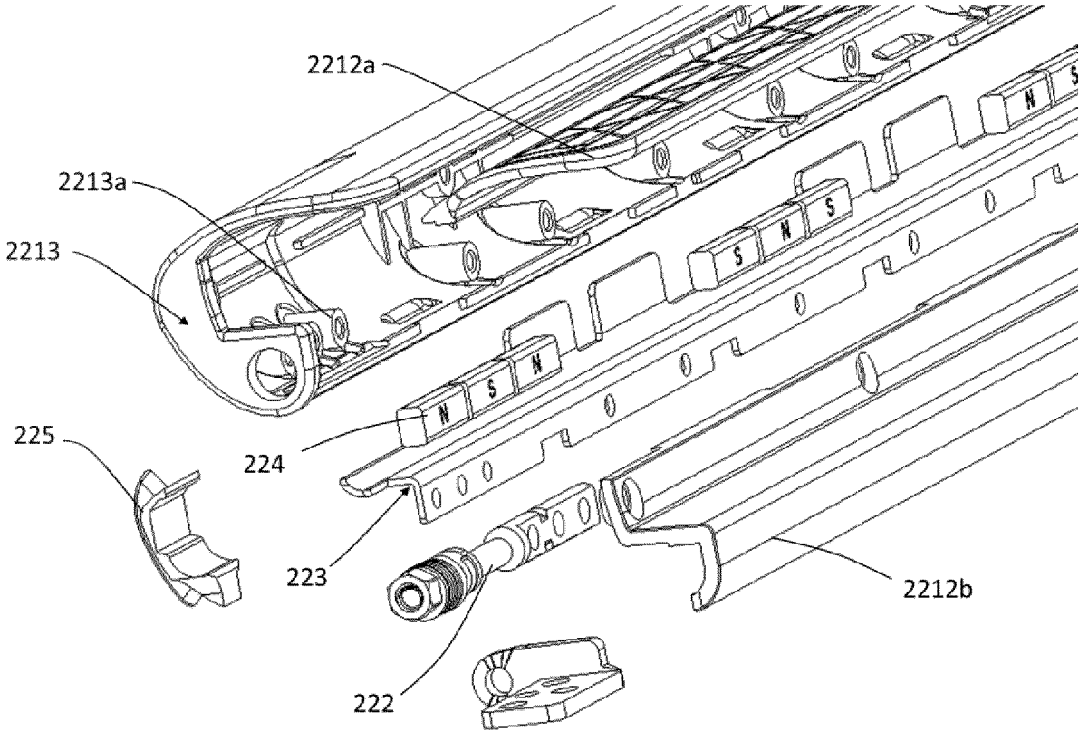


Fig. 7


2212a
2213a
2213
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223
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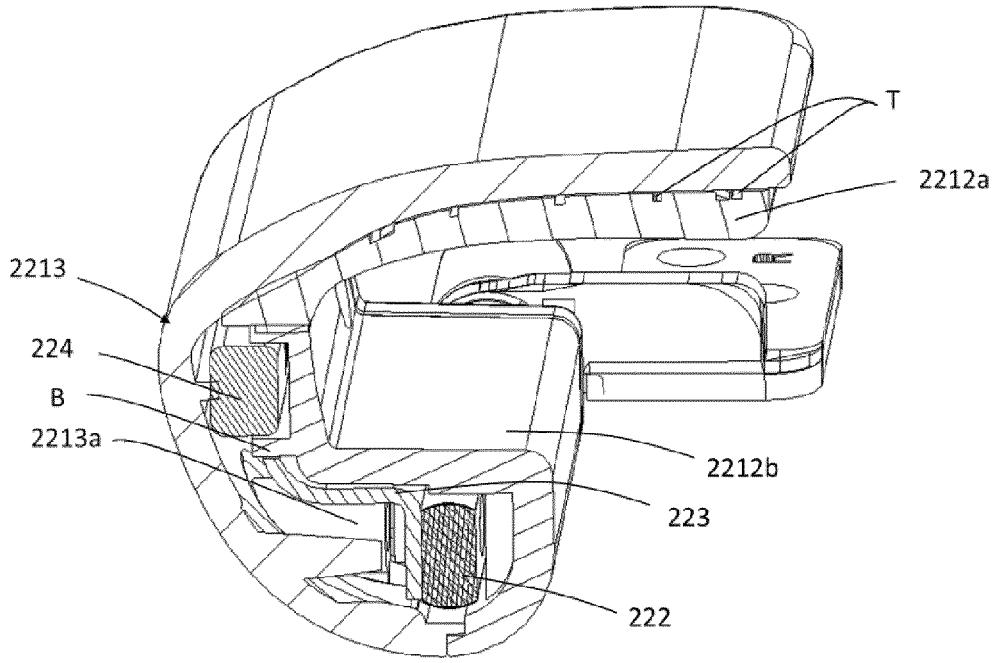
S

Fig. 8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B
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Fig. 9

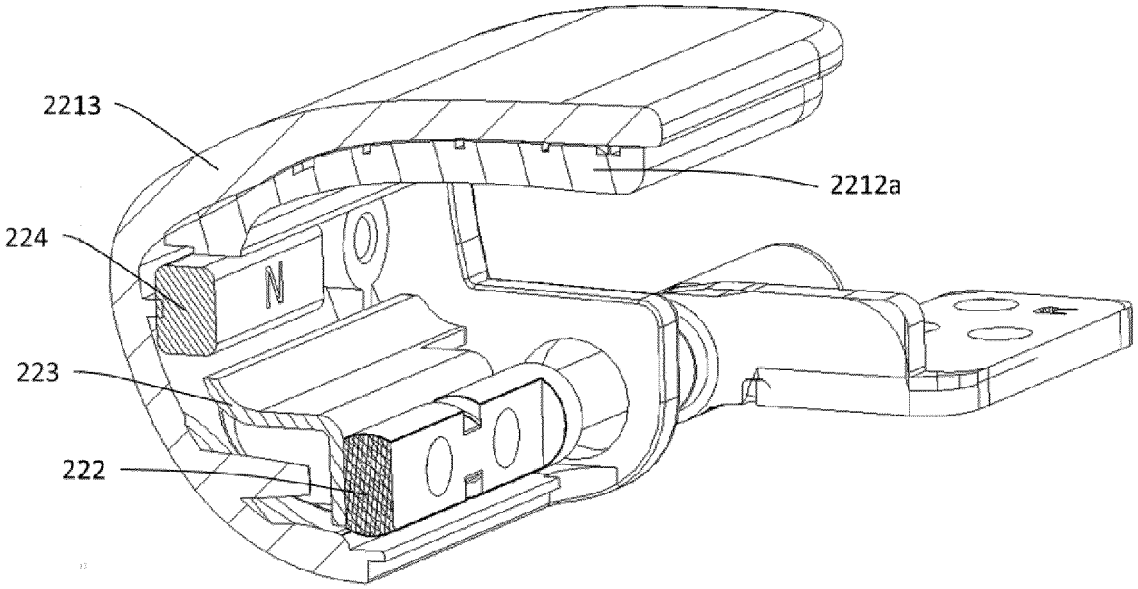

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/105406

A. CLASSIFICATION OF SUBJECT MATTER

G06F 1/16 (2006.01) i; F16C 11/04 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F; F16C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
CNPAT; WPI; EPODOC; CNKI; IEEE: 笔记本, 手提电脑, 平板电脑, 键盘, 转轴, 转动, 弹性, 阻尼, 连接, notebook, ipad, flat, computer, keyboard, rotat+, elastic, damping, connect+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 106444993 A (JRD COMMUNICATION INC.), 22 February 2017 (22.02.2017), description, paragraphs [0028]-[0042]	1-20
A	CN 203858589 U (SHENZHEN DELUX INDUSTRY CO., LTD.), 01 October 2014 (01.10.2014), description, paragraphs [0035]-[0040], and figures 1-11	1-20
A	CN 204009758 U (TONGLIXING ELECTRONIC (SHENZHEN) CO., LTD.), 10 December 2014 (10.12.2014), entire document	1-20
A	CN 204087118 U (TONGLIXING ELECTRONIC (SHENZHEN) CO., LTD.), 07 January 2015 (07.01.2015), entire document	1-20
A	US 2016306386 A1 (LENOVO BEIJING CO., LTD. et al.), 20 October 2016 (20.10.2016), entire document	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 December 2017	12 January 2018
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer JIN, Xia Telephone No. (86-10) 61648480

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/105406

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